Wherefore, what is claimed is:

1. A system for encoding a media signal comprising:

inputting a signal in the form of an integer vector; and

using a reversible transform obtained with at least one reversible matrix lifting operation to encode said signal, comprising :

splitting the integer vector into two complex integer vectors of equal size;

keeping one of the two complex integer vectors of equal size fixed;

transforming the fixed complex integer vector via a float transform to obtain a transformed vector;

rounding the transformed vector to obtain a resultant vector;

either adding the resultant vector to, or subtracting the resultant vector from, the one of the two complex integer vectors that was not kept fixed thereby generating an encoded version of the input signal in integer form.

2. The system of Claim 1 wherein the reversible transform is in the form of a reversible modified discrete cosine transform.

3. The system of Claim 1 wherein the reversible transform has a 2N input and a 2N output with a non-singular characterization matrix $\mathbf{S}_{2N}$.

4. The system of Claim 3 wherein the reversible transform comprises:

$$\mathbf{S}_{2N} = \mathbf{P}_{2N}\begin{bmatrix}\mathbf{I}_N & \\ \mathbf{A}_N & \mathbf{I}_N\end{bmatrix}\begin{bmatrix}\mathbf{B}_N & \\ & \mathbf{I}_N\end{bmatrix}\begin{bmatrix}\mathbf{I}_N & \mathbf{C}_N \\ & \mathbf{I}_N\end{bmatrix}\begin{bmatrix}\mathbf{I}_N & \\ \mathbf{D}_N & \mathbf{I}_N\end{bmatrix}\mathbf{Q}_{2N},$$

where P_{2N} and Q_{2N} are permutation operations,

and wherein after permutation P_{2N}, the input signal is divided into two integer vectors X and Y, which are transformed to resultant integer vectors X' and Y' through:

$$\begin{cases} Y_1 = Y + [D_N X] \\ X_1 = X + [C_N Y] \\ X' = revB_N(X_1)' \\ Y' = Y_1 + [A_N X] \end{cases}$$

where A_N, C_N and D_N are float transforms, $[D_N X]$ $[C_N Y]$ $[A_N X]$ represent vector rounding operations, and Rev B_N is a reversible transform derived from reversible transform B_N.

5. The system of claim 4 wherein vector rounding comprises rounding the individual component of each vector.

6. The system of claim 5 wherein rounding the individual component comprises separately rounding the real and complex coefficients of the individual component.

7. The system of Claim 4 wherein different forms of the reversible transform can be obtained from the linear transform S_{2N} using different permutation matrixes P_{2N} and Q_{2N}, different float transforms A_N, C_N and D_N, and a different reversible transform B_N.

8. The system of Claim 1 wherein the input signal comprises an audio signal.

9. The system of Claim 1 wherein the input signal comprises an image signal.

10. The system of Claim 1 wherein the reversible transform is a reversible Fast Fourier Transform (FFT).

11. The system of Claim 1 wherein the reversible transform is a reversible fractional-shifted Fast Fourier Transform (FFT).

12. The system of Claim 8 wherein the reversible Fast Fourier Transform is a 2N-point reversible Fast Fourier Transform (FFT) F_{2N} implemented via:

$$\mathbf{F}_{2N} = \mathbf{P}_{2N}\begin{bmatrix} \mathbf{I}_N & \\ \mathbf{A}_N & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{B}_N & \\ & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{I}_N & \mathbf{C}_N \\ & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{I}_N & \\ \mathbf{D}_N & \mathbf{I}_N \end{bmatrix}\mathbf{Q}_{2N},$$

wherein $\mathbf{P}_{2N}=\mathbf{I}_{2N}$, $\mathbf{Q}_{2N}=\mathbf{OE}_{2N}$ and the other matrixes in the matrix lifting are:

$$\begin{cases} \mathbf{A}_N = -\sqrt{2}\mathbf{F}_N^T\mathbf{\Lambda}_N(-0.5,0) - \mathbf{I}_N, \\ \mathbf{B}_N = -\mathbf{\Lambda}_N(0.5,0)\mathbf{F}_N\mathbf{F}_N = -\mathbf{\Lambda}_N(0.5,0)\mathbf{T}_N, \\ \mathbf{C}_N = -\dfrac{1}{\sqrt{2}}\mathbf{F}_N^T, \\ \mathbf{D}_N = \left(\sqrt{2}\mathbf{I}_N + \mathbf{F}_N^T\mathbf{\Lambda}_N(-0.5,0)\right)\mathbf{F}_N. \end{cases}$$

where F_N is the forward FFT, $\mathbf{F}_N^t$ is the inverse FFT and T_N is a permutation matrix in the form of:

$$\mathbf{T}_N = \begin{bmatrix} 1 & & & \\ & & & 1 \\ & & \cdot^{\cdot^{\cdot}} & \\ & 1 & & \end{bmatrix}.$$

13. The system of Claim 11 wherein the reversible fractional-shifted transform is a 2N-point reversible fractional-shifted Fast Fourier Transform (FFT) implemented via a reversible transform S_{2N} of matrix lifting followed by N reversible rotations K_{2N}.

14. The system of Claim 13 wherein in the fractionally shifted FFT $\mathbf{F}_{2N}(\alpha,\beta)$, with $\alpha=\beta=0.25$, the reversible rotations K_{2N} take the form

$$\mathbf{K}_{2N}=\begin{bmatrix}\mathbf{\Lambda}_N((1+\beta)/2-\alpha,\alpha) & \\ & W_2^{\beta}\mathbf{\Lambda}_N((1+\beta)/2-\alpha,\alpha)\end{bmatrix},$$

and the reversible transform S_{2N} of matrix lifting is implemented via:

$$\mathbf{S}_{2N}=\mathbf{P}_{2N}\begin{bmatrix}\mathbf{I}_N & \\ \mathbf{A}_N & \mathbf{I}_N\end{bmatrix}\begin{bmatrix}\mathbf{B}_N & \\ & \mathbf{I}_N\end{bmatrix}\begin{bmatrix}\mathbf{I}_N & \mathbf{C}_N \\ & \mathbf{I}_N\end{bmatrix}\begin{bmatrix}\mathbf{I}_N & \\ \mathbf{D}_N & \mathbf{I}_N\end{bmatrix}\mathbf{Q}_{2N},$$

wherein $P_{2N}=I_{2N}$, $Q_{2N}=OE_{2N}$ and the matrixes in the matrix lifting are:

$$\begin{cases}\mathbf{A}_N=-\sqrt{2}\mathbf{\Lambda}_N(-0.25,0.25)\mathbf{F}_N^T\mathbf{\Lambda}_N(-0.25,0)-\mathbf{I}_N, \\ \mathbf{B}_N=-\mathbf{R}_N(0.25)=\begin{bmatrix}-1 & & \\ & & j \\ & \iddots & \\ & j & \end{bmatrix}, \\ \mathbf{C}_N=-\frac{1}{\sqrt{2}}\mathbf{\Lambda}_N(-0.25,0.25)\mathbf{F}_N^T\mathbf{\Lambda}_N(0.25,0.5), \\ \mathbf{D}_N=\mathbf{\Lambda}_N(-0.25,0.25)\left(\sqrt{2}+\mathbf{F}_N^T\mathbf{\Lambda}_N(-0.5,0.125)\right)\mathbf{F}_N\mathbf{\Lambda}_N(0.25,0).\end{cases}$$

15. The system of Claim 1 wherein the input signal is encoded in a lossless manner.

16. The system of Claim 1 wherein the input signal is encoded in a progressive-to-lossless manner.

17. A computer-implemented process for compressing an audio signal comprising the process actions of,

inputting an audio signal;

if the input audio signal is stereo, processing the audio signal through a reversible multiplexer (MUX) which separates into the L+R and L-R components, where L and R represent the audio on the left and right channel, respectively;

if the input audio is mono, passing the audio signal through the MUX;

transforming the waveform of each audio component by a RMDCT module;

grouping the RMDCT coefficients of a number of consecutive windows into a timeslot;

entropy encoding the coefficients in the timeslot using an embedded entropy coder; and

putting the bitstreams of the left and right channels and timeslots together via a bitstream assembly module to form a final compressed bitstream.

18. The process of Claim 17 wherein the RMDCT module is implemented using switching windows.

19. A progressive-to-lossless audio decoder system comprising:

a bit stream unassembler that unassembles the final compressed bitstream into bitstreams of individual channels and timeslots;

an embedded entropy decoder that digitally entropy decodes the bitstream of the individual channels and timeslots;

if the input bitstream is lossless or close to lossless, an inverse RMDCT module that transforms the decoded coefficients to waveform;

if the input bitstream is not close to lossless, an inverse FMDCT module that transforms the decoded coefficients to waveform;

if the audio signal is stereo, an inverse multiplexer that combines the L+R and L-R components.

20. The decoder of Claim 19 wherein the input bitstream comprises the compressed bits of a series of bitplanes and wherein the bitstream is substantially lossless if the transform coefficients can be decoded in the last bitplane.

21. A computer-implemented process for encoding media data, comprising the process actions of:

using a reversible transform component that receives an input signal and provides an output of quantized coefficients corresponding to the input signal, the output of quantized coefficients being based, at least in part, upon a reversible transform obtained via matrix lifting, wherein matrix lifting comprises

inputting the signal in the form of an integer vector;

splitting the integer vector into two complex integer vectors of equal size;

keeping one of the two complex integer vectors of equal size fixed;

transforming the fixed complex integer vector via a float transform to obtain a transformed vector;

rounding the transformed vector to obtain a resultant vector;

either adding the resultant vector to, or subtracting the resultant vector from, the one of the two complex integer vectors that was not kept fixed; and,

using an entropy encoder component that digitally entropy encodes the quantized coefficients.

22. The computer-implemented process of Claim 21 wherein the reversible transform obtained via matrix lifting comprises at least one float Fast Fourier transform.

23. The computer-implemented process of Claim 21 wherein the Fast Fourier Transform is a 2^N point FFT implemented by,

for 1 to N ,

performing a first butterfly operation;

performing a second butterfly operation to obtain an interim result;

dividing the interim result by 2; and

dividing the interim result by $2^{1/2}$ operation if the number of butterfly stages N is odd.

24. The computer-implemented process of Claim 22 wherein the matrix lifting is implemented via fixed float representation, comprising:

converting the input signal to a fixed precision float representation by left shifting a fixed number of bits;

performing a fixed precision float transform using previously-stored fixed precision float coefficients;

outputting a fixed precision float point result; and

rounding the fixed precision float point result to integer values by right shifting a fixed number of bits and adding the carryover bit shifted out.

25. The computer-implemented process of Claim 21 wherein said process actions are stored on a computer-readable medium.

26. The computer-implemented process of Claim 21 wherein the reversible transform is in the form of a reversible modified discrete cosine transform.

27. The computer-implemented process of Claim 21 wherein the reversible transform has a 2N input and a 2N output with a non-singular characterization matrix $\mathbf{S}_{2N}$.

28. The computer-implemented process of Claim 27 wherein the reversible transform comprises: $\mathbf{S}_{2N} = \mathbf{P}_{2N}\begin{bmatrix} \mathbf{I}_N & \\ \mathbf{A}_N & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{B}_N & \\ & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{I}_N & \mathbf{C}_N \\ & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{I}_N & \\ \mathbf{D}_N & \mathbf{I}_N \end{bmatrix}\mathbf{Q}_{2N}$,

where $\mathbf{P}_{2N}$ and $\mathbf{Q}_{2N}$ are permutation operations,

and wherein after permutation $\mathbf{P}_{2N}$, the input signal is divided into two integer vectors $\mathbf{X}$ and $\mathbf{Y}$, which are transformed to resultant integer vectors $\mathbf{X'}$ and $\mathbf{Y'}$ through:

$$\begin{cases} \mathbf{Y}_1 = \mathbf{Y} + [\mathbf{D}_N\mathbf{X}] \\ \mathbf{X}_1 = \mathbf{X} + [\mathbf{C}_N\mathbf{Y}] \\ \mathbf{X'} = \mathbf{revB}_N(\mathbf{X}_1)' \\ \mathbf{Y'} = \mathbf{Y}_1 + [\mathbf{A}_N\mathbf{X}] \end{cases}$$

where $\mathbf{A}_N$, $\mathbf{C}_N$ and $\mathbf{D}_N$ are float transforms, $[\mathbf{D}_N\mathbf{X}]$ $[\mathbf{C}_N\mathbf{Y}]$ $[\mathbf{A}_N\mathbf{X}]$ represent vector rounding operations, and Rev $\mathbf{B}_N$ is a reversible transform derived from reversible transform $\mathbf{B}_N$.

29. The computer-implemented process of claim 28 wherein vector rounding is obtained by separately rounding the real and complex coefficient of the individual component of the vector.

30. The computer-implemented process of Claim 28 wherein different forms of the reversible transform can be obtained from the linear transform $\mathbf{S}_{2N}$ using different permutation matrixes $\mathbf{P}_{2N}$ and $\mathbf{Q}_{2N}$, different float transforms $\mathbf{A}_N$, $\mathbf{C}_N$ and $\mathbf{D}_N$, and a different reversible transform $\mathbf{B}_N$.

31. The computer-implemented process of Claim 21 wherein the input signal comprises an audio signal.

32. The computer-implemented process of Claim 21 wherein the input signal comprises an image signal.

33. The computer-implemented process of Claim 21 wherein the reversible transform is a reversible Fast Fourier Transform (FFT).

34. The computer-implemented process of Claim 21 wherein the reversible transform is a reversible fractional-shifted Fast Fourier Transform (FFT).

35. The computer-implemented process of Claim 33 wherein the reversible Fast Fourier Transform is a 2N-point reversible Fast Fourier Transform (FFT) F_{2N} implemented via:

$$\mathbf{F}_{2N} = \mathbf{P}_{2N}\begin{bmatrix} \mathbf{I}_N & \\ \mathbf{A}_N & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{B}_N & \\ & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{I}_N & \mathbf{C}_N \\ & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{I}_N & \\ \mathbf{D}_N & \mathbf{I}_N \end{bmatrix}\mathbf{Q}_{2N},$$

wherein $\mathbf{P}_{2N}=\mathbf{I}_{2N}$, $\mathbf{Q}_{2N}=\mathbf{OE}_{2N}$ and the other matrixes in the matrix lifting are:

$$\begin{cases} \mathbf{A}_N = -\sqrt{2}\mathbf{F}_N^T\mathbf{\Lambda}_N(-0.5,0) - \mathbf{I}_N, \\ \mathbf{B}_N = -\mathbf{\Lambda}_N(0.5,0)\mathbf{F}_N\mathbf{F}_N = -\mathbf{\Lambda}_N(0.5,0)\mathbf{T}_N, \\ \mathbf{C}_N = -\frac{1}{\sqrt{2}}\mathbf{F}_N^T, \\ \mathbf{D}_N = \left(\sqrt{2}\mathbf{I}_N + \mathbf{F}_N^T\mathbf{\Lambda}_N(-0.5,0)\right)\mathbf{F}_N. \end{cases}$$

where $\mathbf{F}_N$ is the forward FFT, $\mathbf{F}_N^t$ is the inverse FFT and $\mathbf{T}_N$ is a permutation matrix in the form of:

$$\mathbf{T}_N = \begin{bmatrix} 1 & & & \\ & & & 1 \\ & & \cdot^{\cdot^{\cdot}} & \\ & 1 & & \end{bmatrix}.$$

36. The computer-implemented process of Claim 33 wherein the reversible fractional-shifted transform is a 2N-point reversible fractional-shifted Fast Fourier Transform (FFT) implemented via a reversible transform S_{2N} of matrix lifting followed by N reversible rotations K_{2N}.

37. The computer-implemented of Claim 36 wherein in the fractionally shifted FFT $\mathbf{F}_{2N}(\alpha,\beta)$, with $\alpha=\beta=0.25$, the reversible rotations K_{2N} take the form

$$\mathbf{K}_{2N} = \begin{bmatrix} \Lambda_N((1+\beta)/2-\alpha,\alpha) & \\ & W_2^{\beta}\Lambda_N((1+\beta)/2-\alpha,\alpha) \end{bmatrix},$$

and the reversible transform S_{2N} of matrix lifting is implemented via:

$$\mathbf{S}_{2N} = \mathbf{P}_{2N}\begin{bmatrix} \mathbf{I}_N & \\ \mathbf{A}_N & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{B}_N & \\ & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{I}_N & \mathbf{C}_N \\ & \mathbf{I}_N \end{bmatrix}\begin{bmatrix} \mathbf{I}_N & \\ \mathbf{D}_N & \mathbf{I}_N \end{bmatrix}\mathbf{Q}_{2N},$$

wherein $P_{2N}=I_{2N}$, $Q_{2N}=OE_{2N}$ and the matrixes in the matrix lifting are:

$$\begin{cases} \mathbf{A}_N = -\sqrt{2}\Lambda_N(-0.25,0.25)\mathbf{F}_N^{\mathbf{T}}\Lambda_N(-0.25,0)-\mathbf{I}_N, \\ \mathbf{B}_N = -\mathbf{R}_N(0.25) = \begin{bmatrix} -1 & & & \\ & & & j \\ & & \cdot^{\cdot^{\cdot}} & \\ & j & & \end{bmatrix}, \\ \mathbf{C}_N = -\frac{1}{\sqrt{2}}\Lambda_N(-0.25,0.25)\mathbf{F}_N^{\mathbf{T}}\Lambda_N(0.25,0.5), \\ \mathbf{D}_N = \Lambda_N(-0.25,0.25)\left(\sqrt{2}+\mathbf{F}_N^{T}\Lambda_N(-0.5,0.125)\right)\mathbf{F}_N\Lambda_N(0.25,0). \end{cases}$$

38. The computer-implemented process of Claim 21 wherein the input signal is encoded in a lossless manner.

39. The computer-implemented process of Claim 21 wherein the input signal is encoded in a progressive-to-lossless manner.